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ABSTRACT

This study used data from Williams College to implement a quasi-experimental empirical strategy aimed at measuring peer effects in academic outcomes. Data on individual students' grades, Scholastic Assessment Test (SAT) scores, and the SAT scores of their roommates were used. The paper makes the case that first-year roommates are assigned randomly with respect to academic ability, which allows the measurement of differences in grades of high, medium, or low SAT students living with high, medium, or low SAT roommates. These estimates should provide compelling estimates of the effect of roommates' academic characteristics on an individual's grades. The effects of peers at somewhat more aggregated levels are also considered, focusing on the effects associated with different "academic environments" in clusters of rooms that define distinct social units. Results suggest that peer effects are almost always linked more strongly with verbal SAT scores than math SAT scores. Students in the middle of the SAT distribution may do somewhat worse in terms of grades if they share a room with a student who is in the bottom 15% of the verbal SAT distribution. Students in the top of the SAT distribution are least affected by SAT scores of their roommates or entry peers. These effects are not large, but are statistically significant in many models. An appendix contains the housing office questionnaire. (Contains 6 tables and 27 references.) (SLD)

Discussion Paper No. 52

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PEER EFFECTS IN ACADEMIC OUTCOMES:
Evidence from a Natural Experiment

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November, 1999
DP-52

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Abstract

In this paper I use data from Williams College to implement a quasi-experimental empirical strategy aimed at measuring peer effects in academic outcomes. In particular, I use data on individual student's grades, SAT scores, and the SAT scores of their roommates. I argue that first year roommates are assigned randomly with respect to academic ability. This allows me to measure differences in grades of high, medium, or low SAT students living with high, medium or low SAT roommates. With random assignment these estimates would provide compelling estimates of the effect of roommates' academic characteristics on an individual's grades. I also consider the effect of peers at somewhat more aggregated levels. In particular, I consider the effects associated with different "academic environments" in clusters of rooms that define distinct social units. The results suggest that peer effects are almost always linked more strongly with verbal SAT scores than math SAT scores. Students in the middle of the SAT distribution may do somewhat worse in terms of grades if they share a room with a student who is in the bottom 15 percent of the verbal SAT distribution. Students in the top of the SAT distribution are least affected by the SAT scores of their (room or entry) peers. The effects are not large, but are statistically significant in many models.

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Peer Effects in Academic Outcomes: Evidence from a Natural Experiment

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I. Introduction

Peer effects are central to many important issues facing higher (and lower) education. School choice, affirmative action, busing, distance learning, mainstreaming, selective admissions and the rise of merit scholarships at elite schools, for example, all possess the potential to alter the distribution of students within the educational system. At the micro level, these policies can change the composition of one's classmates along various dimensions -- making them more or less racially, socially, geographically, or intellectually diverse. These changes may effect, among other things, students' attitudes, values, or academic performance. In short, changes in the distribution of students may generate peer effects.

Peer effects may also be central to understanding the production of educational services and, through that, the structure of colleges and universities in the United States. The production of higher education is characterized by an unusual "customer input technology" whereby student quality is arguably a key input into the production of educational services -- students may learn better when in the company of other strong students. The fact that students are themselves the only provider of this potentially key input in the production of education could explain why schools care so much about the characteristics of their "customers" and why elite schools create a queue of applicants

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from which to select by regularly setting their tuition well below the full cost of the education they provide (c.f. Winston (1998)).

Measuring peer effects is difficult. Student outcomes depend on a myriad of factors other than the characteristics of one's peers, and isolating peer influences is particularly problematic since people typically *choose* those with whom they associate. Indeed, when students select a college to attend they are importantly choosing the peers with whom they will live and learn for the duration of their college life.

In this paper I use data from Williams College to implement a quasi-experimental empirical strategy aimed at measuring peer effects in academic outcomes. In particular, I use data on individual student's grades, SAT scores, and the SAT scores of their roommates. I argue that, for these schools, first year roommates are assigned randomly with respect to academic ability. This allows me to measure differences in grades of high, medium, or low SAT students living with high, medium or low SAT roommates. With random assignment these estimates would provide compelling estimates of the effect of roommates' academic characteristics on an individual's grades. These estimates, unlike those found in most studies of peer effects, are not tainted by selection bias. I also consider the effect of peers at somewhat more aggregated levels. In particular, I consider the effects associated with different "academic environments" in clusters of rooms that define distinct social units. In addition, I consider the effects of the differential academic abilities of "academic advisors" associated with these social units.

In the next section I provide some background on the academic literature related to peer effects. I then discuss empirical issues related to measuring peer effecs and propose an empirical strategy. In section four, I turn to a description of the data used in my analyses. Finally, I present the empirical results and offer some concluding comments.

II. Background

The study of peer effects spans several academic disciplines. Sociologists have spent considerable time studying "neighborhood effects" – particularly in the contexts of urban poverty and substance abuse (c.f. Jencks and Meyer (1990), Rosenbaum, (1993), Wilson (1987)). A recurring debate in developmental psychology concerns the relative importance of peers versus parents in human development (c.f. Harris (1999)). Medical researchers have considered how patient recovery rates from coronary bypass surgery depend on sharing a hospital room with a roommate who had already had a similar operation (Kulik at. al, (1999)).

Most of the research literature on peer effects in education has focused on the elementary and secondary school level.[1] Certainly the most influential piece of social science research incorporating peer effects is the famous study *Equality of Educational Opportunity* – completed over thirty years ago (James Coleman et al., 1966). Employing over a half million students, from approximately three thousand elementary and secondary schools, Coleman and his associates sought to measure the features of school environment that led to differences in student attainment. A key finding of this study was that "...a pupil's achievement is strongly related to the educational backgrounds and aspirations of the other students in the school." Indeed, peer characteristics were found

[1] My discussion will focus on peer effects defined by the academic characteristics of one's peers. There is an interesting literature on the effect of desegregation in schooling that focuses on the effect of the racial characteristics of one's peers (c.f. Rivkin (1998) and Hoxby (1998)). For evidence on a variety of other peer effects in higher education see Ernest Pascarella and Patrick Terenzini (1991).

to be notably more important than teacher characteristics or non-social aspects of the school.

Henderson, Mieszkowski, and Sauvageau (1978) employed data from approximately seven thousand Montreal students between the first and third grades. Their study found compelling evidence that peer effects were both important and nonlinear. Student performance rose with the average classroom IQ score. The increase, however, slowed as the mean IQ rose. The nonlinearity of the effect is particularly interesting. As noted by McPherson and Schapiro (1990), it suggests that mixing rather than segregating students of different abilities may generate higher aggregate learning. Intuitively, the increase in learning from moving a weak student to a "peer rich" environment exceeds the loss in learning from moving a strong student to a "peer poor" environment. This logic parallels the justification for income equalization in a world with diminishing marginal utility of income.

A recent K-12 study, using the British National Child Development Survey data, related children's standardized math and reading scores – taken at the ages of seven and eleven – to measures of parental and schooling inputs (Robertson and Symons, 1996). Peer effects were captured both by the varying socioeconomic background of the student's peers, along with the "streaming" of students by ability within some schools. They found clear evidence that peer effects were positive and their data too suggested, that they were nonlinear – that poor students were helped more than strong students were hurt. Given their own abilities, students were best off if they were in the top group of a school that sorted by ability and worst off in the bottom group of such a school. Betts (1996), by contrast, using data from the United States finds tracking to have little effect on students' achievement once controls are included for the ability level of students in the non-tracking schools.

Dennis Epple and Richard Romano (1998) develop and simulate a careful theoretical model of secondary school choice that explicity allows for peer effects in the education production function. They note that the Pareto efficient allocation of students depends on the extent of peer group externalities and, in particular, on the degree of complementarity between a student's own ability and that of his or her peers. They also note that there is a paucity of empirical evidence on the magnitude of such complementarities. Their computational results suggest that low-income, low-ability students are more likely to remain in the public schooling sector and sustain losses. Low-income, high-ability students secure the greatest gains from vouchers.

Much of the literature contributed by economists focuses on the impact secondary school spending has on either grades or wages (Burtless, 1996). To disentangle the effects spending might have on student performance it is necessary to control for other variables – such as the quality of the peer environment – that are likely to be correlated with spending. Peer effects are, for this task, simply a nuisance that must be statistically controlled to enable researchers to accomplish their chosen objective of measuring the benefits of additional spending. Typically, a measure of a school's average student quality – usually average SAT scores – is included in wage or grade equations and usually has a significant and positive coefficient (cf. Ehrenberg-Brewer (1996), Behrman et al. (1996), Turner (1996)).

There has been significantly less research done directly on peer effects within higher education. Hall and Willerman (1963), in a study similar in spirit to this one, contrast the grades of roommates at the University of Minnesota who were randomly assigned into groups of differing prior achievement as measured by their high school percentile rank. They found little evidence that higher achieving roommates affected the academic performance of their roommates. Focusing on birth order effects, they found some evidence that first-born students with high ability roommates exhibited larger grade effects than later-born students.

Julian Betts and Darlene Morell use data from five thousand undergraduates at the University of California, San Diego between 1991-1993 to analyze the determinants of students' grade point averages. Their results indicate a significant relationship between students' grade point averages and their gender, ethnicity, parental income, and SAT scores. They also find neighborhood type effects with indicators of the socioeconomic environment of the students' high school being significantly related to grades. Interestingly, they find models of grade determination based simply on SAT scores to predict grades almost as well as more complex models including family background and high school environment variables. These findings might be combined with those of Loury and Garman (1995) -- who find a one-point rise in grade point average to be associated with a ten percent increase in subsequent earnings – to assess the impact of SAT scores on earnings.

Caroline Hoxby (1998) decomposes the growing inequality of wages for college-educated Americans into three components -- a part due to changes in the demographic composition of college attendees, a part due to an increasing return to aptitude, and a final part due to the increasing correlation between student quality and institutional expenditures. The latter effect is a peer effect since high ability students are increasingly likely to have high ability classmates. Hoxby finds that about forty percent of the growth in wage inequality amongst college graduates that can be explained is attributable to such peer effects.

Finally, the economics literature has considered an important methodological issue that is pervasive in all research on peer effects; people often *select* those with whom they associate. This contrasts sharply with an experimental situation in which we might randomly assign people to differing peer environments and then measure their effect on educational attainment. If the peers with whom a person associates share his or her attributes and also affect their attainment (and are unobservable to the researcher) then we might falsely attribute a peer effect where one does not exist. For example, suppose people who associate with low ability friends tend to do worse in school. Perhaps they would have done poorly even if they didn't associate with such people. That is, what might at first look like a peer effect might really be a case of "birds of a feather flocking together." At least two studies by economists have looked at the issue of such "selection bias" in peer effects. Evans et al. (1992) studied peer effects in the context of teen pregnancy and school dropout behavior. Applying an instrumental variables estimator, they found that peer effects disappear once selection bias is controlled. Questioning these results, Steven Rivkin (1997) showed that they are sensitive to the type of instrumental variable used. These papers indicate the importance of taking the selection issue seriously. They also suggest the value of a good experimental or quasi-experimental approach to the measurement of peer effects – something I pursue next.

III. Empirical Strategy

Estimates of peer effects typically use a specification of the form:

$$(1) \qquad O_{ic} = \alpha + \beta_1 C_{ic} + \beta_2 C_{ic}^{Peer} + \varepsilon_{ic}$$

where O is some outcome of interest, i indexes individual students, c indexes cohorts, C is a vector of characteristic of the individual and the school, and C^{Peer} is some characteristic(s) of the individual's peer(s). For example, C might contain the race and gender of the student along with the school's per student spending, average class size, etc. C^{Peer} might contain the average SAT of the student body.

A principal empirical hurdle facing a model of this type is that peers are typically not randomly assigned. If there are characteristics of the individual or the school that are a) omitted from the model that affect O and b) are correlated with C^{Peer} such that $\text{cov}(C_i^{Peer}, \varepsilon_i) \neq 0$ then the estimated peer effect (β_2) will be biased. Such a situation is likely when school inputs affect the quality of the student body and it is difficult to control for all relevant school inputs.

To estimate SAT-based peer effects I relate the grades of students in their first and later semesters to their own SAT scores and to the SAT scores of their first year roommate. More formally, I estimate regression models specified as:

$$(2) \qquad GPA_{ic} = \alpha + \gamma_c + \beta_1 SAT_i + \beta_2 SAT_i^{RM} + \beta_3 X_i + \varepsilon_{ic}$$

where GPA is the student's Grade Point Average measured in first year and also cumulatively to graduation, SAT is the student's own SAT score (sometimes entered separately for math and verbal scores and also sometimes entered nonlinearly), SAT^{RM} is the student's roommate's SAT score (sometimes entered seperately for math and verbal scores and also sometimes entered nonlinearly), and X is a vector of other characteristics (such as race, gender) of the student.[2] If students are randomly assigned their roommate(s), then the estimated peer effect (β_2) will be unbiased. More generally, the estimate will be unbiased if it is plausible that $\text{cov}(SAT^{RM}, \varepsilon_{ic}) = 0$.

There are a variety of possible explanations for why β_2 may differ from zero in this model (c.f. Goethals, Winston, and Zimmerman, (1999)). Work in social psychology, by Leon Festinger (1950, 1954) and others, suggests that people have a powerful need to evaluate their own opinions and values by comparing them to the opinions and values of others (see also Goethals (1999)). When such comparisons take place in group settings there exists a strong tendency towards uniformity. Those inside the group can reward or punish the behavior of its members and uniform standards of behavior come to be expected. Deviation from group standards may encounter sanctions or rewards of various kinds – including status, praise, shame or exclusion. The movement toward uniformity within the group is mediated in various ways, but often by way of talking and listening (or observing). Interaction within the group transmits information which may affect knowledge, values, beliefs, and aspirations. That is, participation within the group may effect change.

Within the context of residential housing, a student's peers may affect how much he or she enjoys learning. Roommates may champion or deprecate the "life of the mind." Bull sessions may explore novel ideas, share insights and inspirations, or delve into the

[2] An appealing alternative strategy would be to include the roommate's GPA in the regression. Such a variable might better measure actual rather than potential performance. The problem with including such a variable is that it is simultaneously determined within the roommate context. Using such a measure would introduce simultaneous equation bias.

implications of classroom lectures or world and campus events. Or, they may be superficial or discouraging or nonexistent. Peers may exhibit good or bad study habits and may or may not offer help on assignments. They may also encourage other activities -- some of which, like partying, might compete with learning.

In sum, it seems clear that there are strong reasons to expect students' peers to influence their own successes and failures. The empirical strategy I employ requires a) the roommate's SAT score to be a reasonable proxy for those conditions that may affect his or her peers and b) the student's room (and other spatial aggregates) to be a meaningful context for locating such effects.

IV. Empirical Results for Williams College

A. Housing Assignment

Each year, students at Williams College are asked to fill out a *Housing Preference Form*. A copy of this form can be found in the Appendix. Students are asked whether they would like to live with a particular person, whether they have any specific health problems (e.g. students with asthma would be more likely to be assigned a room with hardwood floors), and whether they prefer a particular residence. They also indicate their preferences regarding a single versus a double room, whether they smoke, enjoy frequent visitors, most prefer classical music, and so on.

The housing office currently uses this information (alone) to allocate students to rooms and roommates.[3] Rooms are embedded within "entries" that are clusters of rooms

[3] In mid 1990's the Office of the Dean of Students shifted responsibility for student housing assignments to the housing office. The form currently used appears to capture the spirit of the approach used by the Dean's Office.

sharing a common entrance or hall. Entries are typically assigned two "Junior Advisors" – third year students who live in the entry and offer help to the first year students.

A guide to housing offered by the Housing Office defines entries as follows:

Entry (from the Latin word "habitus froshness") n. as a frosh, you will live with a surrogate "family" which we at Williams call an "entry". Imagine a house, filled with a group of frosh, with a couple of enthusiastic and seasoned juniors bringing everyone together. They can be either vertically or horizontally arranged, so you will either have these individual yet connected "houses" next door or up and downstairs from you.[4]

The Housing Office uses the following protocol in assigning rooms.[5] First, applications are separated by gender[6]. Within gender groups, applications are separated by the preferred first year housing units (i.e. the "Hall Preference" ranking on the form). Of the eight remaining items A – H on the forms, items A (preference for a single room) and B (smoker or non-smoker) carry the most weight. Items C (attitude towards visitors), F (preference regarding noise), G (neatness), and H (sleep patterns) are treated as a group and attempts are made to match people who are "similar" in these dimensions. According to the Housing Office, items D and E carry "significantly less weight" and tend to have a "very minor" impact on assignment.

These variables are of some importance in determining whether estimates of roommate effects will be biased. Consider, for example, a situation in which all students are roomed together who respond that "preferred study setting" includes "lots of noise" (F1 on the housing form). Suppose further that such a preference would, holding SAT

[4] WCHG 101F Introduction to the Twentieth Century Frosh Dorm, Chris Bell '98, Williams College Housing Office, 1997.

[5] Note that there is no price difference between units and applications are not evaluated on a first come first serve basis.

[6] Entries (clusters of rooms connected by a stairway or hall and sharing a "common room") were partially single sex in the early years of the sample. For the classes of '90-93 and '95 about one third of the students were in single sex entries. For the class of '94 about 10% of the students were in single sex entries. All entries were "mixed" after '95. Virtually all rooms are single sex throughout the period. Controlling for single-sex entries has little effect on the results.

scores and other measured characteristics constant, be associated with lower grades. Suppose also that such a preference would, on average, be associated with lower SAT scores. Then, $\mathrm{cov}(SAT^{RM}, \varepsilon_{ic}) \neq 0$ since ε_{ic} would include a student's preference regarding their study setting which, due to the system of housing assignment, would be correlated with his or her roommate's preference regarding their study setting which, by assumption, would be correlated with the roommate's SAT score. More simply, low SAT students matched with low SAT students would be more apt to prefer noisy study environments than low SAT students matched with high SAT students (who prefer a quieter study setting). Differences in grades between these two groups would reflect the effect of their study setting preference on grades along with any causal peer effect.

It is worth noting that neither ethnicity, nor prior academic performance, nor athletic affiliations -- all characteristics that might create a problematic selection bias -- are used by the Housing Office in assigning students to rooms and roommates. If such factors do affect the allocation of first year students they must act indirectly through the categories present on the form.[7] It is also worth noting that estimates could be similarly biased by self selection if students were able to choose their roommates and did so based on characteristics that were associated with their prior performance -- as measured by their SAT scores -- or with future academic performance – as measured by grades with SAT scores held constant.

B. Is it Random?

I gathered data from the Housing Office at Williams College for the Housing Preference Form for the Class of '02 to determine whether estimates of peer effects using housing data are likely to be contaminated by selection bias.[8] Tabulations of the students responses and their association with SAT scores and grades are found in Table 1.

From the second column in this table we see that about 5 percent of students indicate a preference for a specific roommate (with ten pairs, or 3.8 percent, of students actually being granted this request) and a similar proportion indicate they have "special needs". Almost 60 percent of students indicated they would prefer a single room (with about 1/3 of all students receiving a single room), 1.34 percent indicate they are smokers and 2.87 percent indicate they prefer not to have visitors. Most students least like heavy metal music and video games and most claim to be relatively organized. Few are "morning

Column three presents simple regression coefficients for each housing preference when regressed on the student's combined SAT score. For example, smokers are found, on average, to have SAT scores 193 points lower than non-smokers. This difference is statistically significant. Similarly, students who prefer studying in "silence" have SAT scores about 237 points higher, on average, than students who like studying with "lots of noise". Again, the difference is statistically significant. From this column, we see that several of the housing preferences indicated by students are significantly related to SAT scores.

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[7] Beginning with the class of 2003 the housing office runs a "check" to make sure that entries are "diverse". In particular, they aim to be sure that there is not a clustering of athletes or racial minorities in freshman dormitories.

[8] The Housing Preference Forms for earlier years had been destroyed.

Column four shows the results of a set of multiple regressions – one for each of the student housing preferences. The dependent variable in these regressions is the student's cumulative grade point average and the explanatory variables are the indicated housing preference variable along with the student's race, citizenship, gender, and math and verbal SAT scores. This column helps identify those variables that are individually associated with a student's grades after controlling for the other measurable characteristics. Most of the student housing variables are not statistically significantly related to their grades. While smokers have, on average, lower SAT scores this does not translate into lower grades once SAT scores and other characteristics are controlled in the regression. Interestingly, grades are not related to how neat a student is or to their sleep patterns or to their preferred level of noise during study times once SAT scores and other controls are included in the model.

Estimates of the peer effect in equation (2) would be biased if a given housing preference is a) significant in both SAT and GPA regressions and b) a consequential determinant of a student's actual housing assignment. Only three characteristics are significant in both regressions – D1 (least preferred activity is "cultural") and E3, E5 (least preferred music is "heavy metal" or "rap"). Importantly, these characteristics are associated with the preferences receiving the least weight by the Housing Office in determining assignments. According to the Housing Office the practical effect of these particular responses is trivial. These results suggest that it is reasonable to assume that housing assignment is random for the purposes of this study. If true, this allows us to interpret any measured peer effects as being causal.

C. Data and Descriptive Statistics

Table 2 provides summary statistics for the sample used. Data for the Class of 1990 through the Class of 2001 are used. The average size of the entering class was 522 students over the eleven year period. SAT scores – which were re-centered -- ranged from a low of 360 in the verbal test and 330 in the math test to a maximum of 800 in both tests. The average combined SAT score was 1396 over the period. These scores are high, putting the average student in the top 10 percent of the population of test takers. The table also shows the cutoffs for various percentiles of the Williams SAT distribution. For example, combined SAT scores below 1250 placed students in the lowest 15 percent of the pooled class. The average SAT score for this group was 1175 which, while in the lower tail of the distribution at Williams, would be at about the 75th percentile in the population.

Average math and verbal SAT scores were calculated for each entry in each year. Entries with average math SAT scores of 664 were at the 15th percentile of the distribution. Similarly, each year average SAT scores are calculated for the Junior Advisors associated with each entry.

Finally, during this period, about half of the class were women, about 7 percent were black, and about 6 percent were Hispanic.

D. Roommate Effects?

Table 3 presents estimates of equation (2). In the first column the student's first semester first year grades are regressed on their own SAT score (divided by 100), race, gender, major, class cohort, and roommate's SAT score. The model includes controls for a student's major (which is selected in junior year) to provide some control for grade differentials arising from students taking different courses. Similarly, class cohort dummy variables provide a control for college-wide changes in grades over time.

A student's own SAT score is large and statistically significant, with each 100 point increase translating into a .163 increment in their grade point average. After controlling for SAT scores, black and Hispanic students score between a fifth and a quarter of a grade point below white students. Female students score .123 points higher than male students. Roommate's SAT score is found to have no effect.[9]

Column 2 repeats the same regression, but now uses a student's cumulative GPA rather than their first year first semester GPA. The results are similar – again, showing no evidence of a peer effect.

In columns 3 and 4, a student's verbal and math SAT score are entered separately. In this case, the roommate's verbal SAT score is significant while their math score is not. The effect is small, with a 100 point increment in roommate's verbal score translating into a .03 increase in the students GPA.[10] This effect is about 15 percent as large as a 100 point increment in the student's own verbal SAT score. Similar results are found using either first semester or cumulative GPA as the dependent variable.

Table 4 reports estimates of equation (2) allowing the peer effect to depend on the student's own position in the SAT distribution. Panel A allows us to see whether weak, average, or strong students (as measured by their SAT scores) are more, or less, affected by roommates. The results in this panel suggest that neither weak nor strong students

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[9] Estimates are provided using only students living in "doubles". i.e. with a single roommate. This comprises the great majority of roommate situations at Williams. Including all observations for multiple roommate rooms has virtually no effect on the results.

(those in the bottom or top 15 percent of the combined SAT distribution) are affected by their roommate's verbal or math SAT scores. Students in the middle 70 percent of the distribution, however, show a positive peer effect associated with their roommate's verbal SAT score. Within this group, a 100 point increase in roommate's verbal SAT score translates into a .043 increase in GPA.

Panel B allows the peer effect to be nonlinear. That is, it allows us to see whether weak, average, or strong students (as measured by their SAT scores) are more, or less, affected by having roommates who are weak, average, or strong in terms of their math and verbal SAT scores. Again, no peer effects are found for students at the top and the bottom of the combined SAT distribution. Students in the middle 70 percent of the distribution are found to have grades lower by .077 -- after controlling for own SAT scores, race, gender, etc. -- when they have a roommate in the bottom 15 percent rather than the top 15 percent of the verbal SAT distribution. This effect, while statistically significant, is not large. It would lower a student at the median of the GPA distribution to about the 42nd percentile.

Table 5 reports estimates of equation (2) separately for men and women. Again, peer effects are only found for the middle 70 percent of the SAT distribution. Estimates for men are shown in Panel A. For men, having a roommate in the lowest 15 percent of the verbal SAT distribution is associated with a reduction in GPA of .088 points. This would lower a student at the median of the GPA distribution to about the 38th percentile.

Estimates for women are shown in panel B. Here the results are somewhat different. No peer effects are found for women in the top or bottom 15 percent of the SAT

[10] The effect, while "small", could still be consequential if it moved a student below a grade cutoff for attending, for example, law or medical school.

distribution. Within the middle 70 percent of the SAT distribution, however, women with roommates in the lowest 15 percent of the math distribution show grades .070 points higher. This effect is significant at the 5 percent level. No significant peer effects are associated with verbal scores.

E. Entry Effects?

Table 6 reports estimates that incorporate entry effects along with characteristics of the entries' Junior Advisors. Similar to the roommate effects, entries and Junior Advisors are classified by whether they are in the lowest 15 percent, middle 70 percent, or top 15 percent of their respective SAT distributions. Estimates in the first column do not separate students by their SAT scores. Again, peer effects are found at the roommate level. Having a roommate in the lowest 15 percent of the verbal SAT distribution is associated with grades being lowered by .057. Entry effects are also found. In this case, living in an entry characterized as being in the lowest 15 percent verbal SAT scores of all entries is associated with a .059 reduction in grades.

In columns two through four, this model is estimated for each of the three SAT groups. In this case, the lowest 15 percent of students are found to have lower grades if they live in a low verbal SAT score entry. The entry effect is significant and large. It would drop a median student in this SAT group from about the 17^{th} percentile to about the 10^{th} percentile of the grade distribution. No entry level peer effects are found for the other two groups.

Columns five through seven report estimates of equation (2) that allow for peer effects associated with the average SAT scores of the Junior Advisors living in the entry.[11] Again, negative peer effects – associated with low verbal SAT scores -- are found at the roommate level. Low SAT students are also found to perform better in the presence of low math SAT roommates. There is no evidence of either entry or Junior Advisor peer effects in these models.

V. Conclusions

This paper investigates peer effects in the determinants of grades. In particular, I measure differences in grades associated with high, medium, or low SAT students living with high, medium or low SAT roommates. I argue that housing assignment is random. This allows me to interpret any grade differences between the SAT groups as measuring a causal peer effect. The more robust findings suggest that in the context of residential housing:

1) Peer effects are almost always linked more strongly with verbal SAT scores than math SAT scores.
2) Students in the middle of the SAT distribution may do somewhat worse in terms of grades if they share a room with a student who is in the bottom 15 percent of the verbal SAT distribution.
3) Students in the top of the SAT distribution are least affected by the SAT scores of their (room or entry) peers.
4) The effects are not large, but are statistically significant in many models.

[11] The sample size is reduced somewhat as Junior Advisor SAT data are not available for classes prior to 1990. The class of '92 is the first class for which JA data are available.

These results must be interpreted with some caution. First, it must be remembered that they are measured within the context of a highly selective school. Their applicability to several important issues in higher education must be tempered. For example, school choice might be characterized as moving the more able or motivated children from poorer schools into schools that are richer in terms of both peer and other resources. In the context of this study, I measure the effect on students -- who already attend resource rich institutions – of having different peer environments in their residential housing situations. The nonlinearity of this effect -- middle SAT students are affected while others are not – is not the same as the nonlinearity issue involved in moving a weak student to a strong school and a strong student to a weak school. In that case, both peer and other educational resources are altered.

Table 1: Is Room Assignment Random? Williams Class of '02

	Distribution (%)	SAT Score	Cumulative GPA
Specific Roommate Requested? (1=yes)	4.96	-171.32	-.014
		(41.42)	(.082)
Special Needs Indicated? (1=yes)	4.39	-14.31	-.143
		(44.62)	(.083)
A. Would you prefer a single or a double? (double=1)	58.43	-20.63	.062
		(18.64)	(.035)
B. Are you a smoker or non-smoker? (1=nonsmoker)	1.34	192.94	.018
		(85.58)	(.162)
C. How do you think you will feel towards visitors to your room?			
1. Enjoy frequent visitors (excluded category)	27.72		
2. like periodic visitors	69.41	24.58	.140
		(20.63)	(.038)
3. prefer not to have visitors	2.87	49.44	.204
		(56.78)	(.105)
D. From the list below, please indicate in box D your least preferred activity.			
1. cultural (theater, symphony, etc.)	29.29	84.00	-.259
		(40.43)	(.077)
2. video games	37.76	119.94	-.118
		(39.63)	(.076)
3. concerts (excluded category)	6.17		
4. large parties	26.59	181.53	-.054
		(40.78)	(.078)
E. From the list below, please indicate in box E your least preferred musical taste.			
1. classical (excluded category)	10.17		
2. rock/pop	3.03	97.58	.204
		(58.94)	(.109)
3. heavy metal	57.20	63.71	.186
		(30.81)	(.060)
4. oldies	4.03	-32.29	.126
		(54.22)	(.101)
5. rap	25.53	118.55	.286
		(33.56)	(.064)
F. Place the number of your preferred study setting in box			
1. lots of noise / people (excluded category)	1.53		
2. some background noise / music	60.99	240.75	-.053
		(74.29)	(.141)
3. silence	37.48	237.18	-.011
		(74.87)	(.142)
G. Place in box G the number which best describes the condition which you expect to keep your room.			
1. impeccably neat (excluded category)	7.27		
2. relatively organized	51.43	27.26	-.057

		(36.05)	(.069)
3. somewhat cluttered	36.90	74.95	-.084
		(36.92)	(.071)
4. hidden / buried floor	3.82	122.55	-.073
		(57.44)	(.109)
5. disaster area	.57	64.38	-.025
		(124.70)	(.235)
H. Place in box H the number which best describes your wake / sleep patterns.			
1. early riser / morning person (excluded category)	3.64		
2. early riser / daytime person	19.92	67.38	-.068
		(52.23)	(.097)
3. early riser / evening person	20.69	39.11	-.139
		(52.08)	(.097)
4. late riser / daytime person	13.03	101.46	-.064
		(54.28)	(.101)
5. late riser / evening person	27.01	72.13	-.184
		(51.12)	(.095)
6. late riser / night person	15.71	50.02	-.296
		(53.32)	(.098)
Sample Size	519	519	519

Note:

1. SAT regressions show the reported coefficient(s) from a bivariate regression of the student's combined SAT score on the relevant survey characteristic.
2. GPA regressions show the reported coefficient(s) from a multiple regression of the student's cumulative GPA score on the relevant survey characteristic regression and controls for race, citizenship, gender, and own math and verbal SAT scores.
3. Shaded coefficients are significant at the 5% level.

Table 2: Descriptive Statistics
Williams Class of '90 – '01

	Mean	Standard Deviation	Minimum	Maximum
Class Cohort	1995	3.46	1990	2001
Class Size	522	16.47	496	552
First Semester First Year GPA	3.10	.510	1.08	4.17
Cumulative GPA	3.24	.419	1.09	4.17
Own SAT Score – Verbal	708	73	360	800
Own SAT Score – Math	688	71	330	800
Own SAT Score – Combined	1396	123	830	1600
Black	.073	.260	.058	.099
Hispanic	.058	.234	.027	.085
Native American	.002	.047	0	.005
Asian	.094	.293	.058	.101
Not a Citizen of the United States	.028	.166	.012	.055
Female	.472	.499	.429	.510
Combined SAT Score (lowest 15%)	1175	69	830	1250
Combined SAT Score (Imiddle70%)	1399	67	1260	1500
Roommates Verbal SAT Score – Lowest 15%	580	42	360	620
Roommates Verbal SAT Score – Middle 70%	699	36	630	750
Roommates Math SAT Score – Lowest 15%	568	41	330	610
Roommates Math SAT Score – Middle 70%	680	33	620	740
Entry's Verbal SAT Score – Lowest 15%	671	16	628	686
Entry's Verbal SAT Score – Middle 70%	707	10	687	724
Entry's Math SAT Score – Lowest 15%	653	13	605	664
Entry's Math SAT Score – Middle 70%	686	10	665	703
Entry Size	22	4.99	11	35
Entry JA's Verbal SAT Score – Lowest 15%	616	24	490	637
Entry's JA's Verbal SAT Score – Middle 70%	709	30	640	755
Entry's JA's Math SAT Score – Lowest 15%	577	50	430	610
Entry's JA' Math SAT Score – Middle 70%	679	35	615	750

Table 3: Your Grades and Your Roommate's SAT Scores
Williams Class of '90 – '01

	First Semester GPA	Cumulative GPA	First Semester GPA	Cumulative GPA
Own SAT Score/100	.163	.147		
	(.007)	(.006)		
Own SAT Score – Verbal/100			.201	.195
			(.013)	(.011)
Own SAT Score – Math/100			.120	.092
			(.014)	(.011)
Black	-.249	-.250	-.261	-.264
	(.042)	(.034)	(.042)	(.033)
Hispanic	-.220	-.157	-.222	-.160
	(.045)	(.036)	(.045)	(.035)
Native American	.315	.093	.317	.098
	(.116)	(.169)	(11.44)	(.175)
Not a Citizen of the United States	.184	.079	.198	.099
	(.043)	(.043)	(.044)	(.043)
Asian	-.117	-.092	-.111	-.085
	(.029)	(.023)	(.029)	(.022)
Female	.123	.148	.105	.128
	(.016)	(.013)	(.017)	(.013)
Major Dummy Variables	YES	YES	YES	
Class Cohort Dummy Variables	YES	YES	YES	
Roommates SAT Score/100	.007	.006		
	(.006)	(.005)		
Roommates SAT Score – Verbal/100			.030	.027
			(.012)	(.010)
Roommates SAT Score – Math/100			-.018	-.016
			(.013)	(.010)
Sample Size	3151	3151	3151	3151
R- Squared	.324	.369	.328	.378

Note: Standard Errors are corrected for correlation within roommate cluster.
Shaded peer coefficients are significant at the 5% level.

Table 4: Your Grades and Your Roommate's SAT Scores by SAT Group -- Williams Class of '90 – '01 (Dependent Variable is Cumulative GPA)

	Combined SAT Score (lowest 15%)	Combined SAT Score (middle 70%)	Combined SAT Score (top 15%)
A. Linearity in Roommates Scores			
Own SAT Score – Verbal/100	.205 (.039)	.199 (.015)	.118 (.055)
Own SAT Score – Math/100	.065 (.036)	.112 (.017)	.045 (.051)
Black	-.181 (.046)	-.386 (.053)	-.800 (.059)
Hispanic	-.036 (.059)	-.254 (.046)	-.050 (.274)
Native American	-.238 (.169)	.212 (.168)	dropped
Not a Citizen of the United States	.076 (.091)	.126 (.055)	.055 (.066)
Asian	.210 (.120)	-.065 (.026)	-.201 (.047)
Female	.262 (.038)	.103 (.016)	.107 (.028)
Major Dummy Variables	YES	YES	YES
Class Cohort Dummy Variables	YES	YES	YES
Roommates SAT Score – Verbal/100	.006 (.025)	.043 (.012)	-.013 (.021)
Roommates SAT Score – Math/100	-.038 (.028)	-.021 (.012)	.030 (.022)
Sample Size	450	2072	629
R- Squared	.408	.273	.205

	Combined SAT Score (lowest 15%)	Combined SAT Score (middle 70%)	Combined SAT Score (top 15%)
B. Non-linearity in Roommates Scores			
Own SAT Score – Verbal/100	.203 (.039)	.201 (.015)	.119 (.055)
Own SAT Score – Math/100	.063 (.035)	.112 (.017)	.051 (.051)
Black	-.183 (.045)	-.387 (.053)	-.800 (.058)
Hispanic	-.034 (.060)	-.254 (.046)	-.074 (.262)
Native American	-.223 (.175)	.211 (.181)	dropped
Not a Citizen of the United States	.066 (.092)	.125 (.055)	.035 (.061)
Asian	.212 (.120)	-.066 (.026)	-.194 (.047)
Female	.263 (.037)	.104 (.017)	.104 (.027)
Major Dummy Variables	YES	YES	YES
Class Cohort Dummy Variables	YES	YES	YES
Roommates Verbal SAT Score – Lowest 15%	-.035 (.055)	-.077 (.027)	-.038 (.047)
Roommates Verbal SAT Score – Middle 70%	-.010 (.045)	-.011 (.016)	.038 (.027)
Roommates Math SAT Score – Lowest 15%	.092 (.055)	.048 (.026)	.007 (.046)
Roommates Math SAT Score – Middle 60%	.004 (.045)	.023 (.019)	-.028 (.027)
Sample Size	450	2072	629
R- Squared	.410	.272	.209

Note: Standard Errors are corrected for correlation within roommate cluster.
Shaded peer coefficients are significant at the 5% level.

Table 5: Your Grades and Your Roommate's SAT Scores by Gender Williams Class of '90 – '01

	Combined SAT Score (lowest 15%)	Combined SAT Score (middle 70%)	Combined SAT Score (top 15%)
A. Men			
Own SAT Score – Verbal/100	.249 (.067)	.217 (.023)	.055 (.075)
Own SAT Score – Math/100	.052 (.049)	.129 (.026)	.021 (.066)
Black	-.175 (.071)	-.410 (.078)	-.850 (.071)
Hispanic	.065 (.099)	-.288 (.071)	-.111 (.380)
Native American	-.066 (.272)	-.333 (.047)	dropped
Not a Citizen of the United States	.044 (.136)	.138 (.076)	.014 (.083)
Asian	.489 (.409)	-.001 (.043)	-.190 (.064)
Female			
Major Dummy Variables	YES	YES	YES
Class Cohort Dummy Variables	YES	YES	YES
Roommates Verbal SAT Score – Lowest 15%	-.040 (.083)	-.088 (.041)	-.093 (.060)
Roommates Verbal SAT Score – Middle 70%	-.019 (.076)	-.012 (.026)	.003 (.036)
Roommates Math SAT Score – Lowest 15%	-.009 (.087)	.015 (.040)	.003 (.057)
Roommates Math SAT Score – Middle 70%	-.044 (.070)	.028 (.027)	-.039 (.032)
Sample Size	230	1044	411
R- Squared	.423	.274	.213

	Combined SAT Score (lowest 15%)	Combined SAT Score (middle 70%)	Combined SAT Score (top 15%)
B. Women			
Own SAT Score – Verbal/100	.180 (.046)	.187 (.021)	.230 (.099)
Own SAT Score – Math/100	.077 (.050)	.100 (.022)	.071 (.094)
Black	-.171 (.060)	-.356 (.076)	dropped
Hispanic	-.032 (.076)	-.211 (.055)	-.057 (.092)
Native American	dropped	.326 (.092)	dropped
Not a Citizen of the United States	.163 (.111)	.117 (.080)	.090 (.135)
Asian	.267 (.115)	-.116 (.033)	-.185 (.076)
Female			
Major Dummy Variables	YES	YES	YES
Class Cohort Dummy Variables	YES	YES	YES
Roommates Verbal SAT Score – Lowest 15%	-.040 (.076)	-.040 (.039)	.046 (.082)
Roommates Verbal SAT Score – Middle 70%	.014 (.066)	-.009 (.022)	.068 (.043)
Roommates Math SAT Score – Lowest 15%	.201 (.076)	.070 (.035)	.006 (.085)
Roommates Math SAT Score – Middle 70%	.068 (.059)	.029 (.027)	.038 (.054)
Sample Size	220	1028	218
R- Squared	.360	.254	.349

Note: Standard Errors are corrected for correlation within roommate cluster.
Shaded peer coefficients are significant at the 5% level.

Table 6: Your Grades and Your Entry's/Junior Advisor's SAT Scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Cumulative GPA	Combined SAT Score (lowest 15%)	Combined SAT Score (middle 70%)	Combined SAT Score (top 15%)	Combined SAT Score (lowest 15%)	Combined SAT Score (middle 70%)	Combined SAT Score (top 15%)
Own SAT Score – Verbal/100	.191	.170	.200	.120	.116	.213	.054
	(.011)	(.039)	(.016)	(.057)	(.047)	(.018)	(.073)
Own SAT Score – Math/100	.097	.064	.119	.056	.040	.123	.001
	(.011)	(.035)	(.018)	(.051)	(.052)	(.023)	(.068)
Black	-.264	-.187	-.390	-.771	-.158	-.459	-.766
	(.034)	(.046)	(.056)	(.063)	(.067)	(.066)	(.083)
Hispanic	-.159	-.051	-.257	-.093	.032	-.306	-.491
	(.036)	(.060)	(.046)	(.254)	(.067)	(.054)	(.337)
Native American	.091	-.324	.213	dropped	dropped	.521	dropped
	(.180)	(.181)	(.187)			(.222)	
Not a Citizen of the United States	.099	.070	.126	.034	.035	.118	.135
	(.043)	(.089)	(.057)	(.064)	(.140)	(.075)	(.089)
Asian	-.083	.196	-.065	-.192	.162	-.053	-.185
	(.022)	(.126)	(.026)	(.047)	(.099)	(.031)	(.060)
Female	.124	.252	.096	.102	.212	.092	.068
	(.014)	(.037)	(.017)	(.027)	(.046)	(.019)	(.035)
Major Dummy Variables	YES	YES	YES	YES	YES	YES	YES
Class Cohort Dummy Variables	YES	YES	YES	YES	YES	YES	YES
Roommates Verbal SAT Score – Lowest 15%	-.057	-.014	-.076	-.027	-.084	-.062	-.032
	(.022)	(.056)	(.028)	(.049)	(.069)	(.032)	(.059)
Roommates Verbal SAT Score – Middle 70%	.000	-.002	-.013	.037	-.048	-.010	.019
	(.014)	(.045)	(.017)	(.027)	(.056)	(.021)	(.033)
Roommates Math SAT Score – Lowest 15%	.046	.087	.046	.015	.153	.041	.028
	(.021)	(.057)	(.026)	(.046)	(.071)	(.032)	(.061)
Roommates Math SAT Score – Middle 70%	.004	-.006	.022	-.027	-.008	.034	-.036
	(.015)	(.046)	(.019)	(.027)	(.053)	(.023)	(.036)
Entry's Verbal SAT Score – Lowest 15%	-.059	-.192	-.028	-.064	-.114	.029	.025
	(.026)	(.072)	(.032)	(.065)	(.106)	(.044)	(.087)
Entry's Verbal SAT Score – Middle 70%	.008	-.036	-.002	.035	-.002	.028	.037
	(.016)	(.059)	(.020)	(.027)	(.069)	(.026)	(.038)
Entry's Math SAT Score – Lowest 15%	.034	.034	.047	-.013	.024	.028	-.020
	(.025)	(.070)	(.031)	(.052)	(.082)	(.041)	(.066)
Entry's Math SAT Score – Middle 70%	-.002	.025	.014	-.041	-.003	.025	-.054
	(.019)	(.061)	(.023)	(.030)	(.067)	(.033)	(.042)
Entry JA's Verbal SAT Score – Lowest 15%					-.151	-.019	-.021
					(.093)	(.036)	(.060)
Entry's JA's Verbal SAT Score – Middle 70%					-.086	.010	-.011
					(.064)	(.028)	(.040)
Entry's JA's Math SAT Score – Lowest 15%					.183	-.009	.090
					(.126)	(.054)	(.074)
Entry's JA' Math SAT Score – Middle 70%					.103	.010	.016
					(.113)	(.045)	(.056)
Sample Size	3117	443	2049	625	280	1294	404
R- Squared	.384	.432	.276	.219	.389	.318	.237

Note: Standard Errors are corrected for correlation within roommate cluster.
Shaded peer coefficients are significant at the 5% level.

Appendix A

Spring, 1999

Dear Incoming First Year Student:

On behalf of the Housing Office, welcome to the Class of 2003! We are looking forward to seeing you later in the summer.

Williams houses first year students and their JA's in six residential buildings. We try to create first year living units to reflect the variety found within the class. Thus, assignments to housing are made to foster the educational experience of living with classmates of different interests and backgrounds, while also recognizing the need for roommates to be compatible.

Enclosed is an informational booklet that will give you a peek at first year living at Williams. Please refer to it in the upcoming weeks as you gear up for dorm life, feeling free to direct any further inquiries to the Housing Office.

Also enclosed is a form that will give you the opportunity to provide information about yourself and your preferred rooming situation for next year. Please be mindful that while we will certainly consider your preference for a particular building, we cannot guarantee an assignment to it. The roommate matching questionnaire should be completed as carefully and honestly as possible, considering your general personality and behavior. Your choices should be made while imagining yourself living on your own without the structure to which you are accustomed. The form is to be completed and returned by June 25 to the Director of Housing, Williams College, 60 Latham St., Williamstown, MA 01267.

Please be sure to submit the preference form by June 25. We expect to mail first year room assignments in late July or early August. Meanwhile, should you have any questions or if you would like more information about residential living at Williams, please feel free to contact me. My e-mail address is thomas.d.mcevoy@williams.edu. Have a great summer and I look forward to seeing you soon.

Sincerely,
Thomas D. McEvoy
Director of Housing

WILLIAMS COLLEGE
HOUSING PREFERENCE FORM
CLASS OF 2003

NAME (please type or print)

____

SEX **male** ________ **female** ________
SOCIAL SECURITY NUMBER ______________________________
HOME ADDRESS ______________________________
HOME PHONE NUMBER ______________________________

ROOMMATE REQUEST: IF YOU WOULD LIKE TO LIVE WITH A SPECIFIC PERSON, PLEASE LIST THAT PERSON'S NAME BELOW. YOUR REQUEST WILL BE HONORED IF THE PERSON ALSO LISTS YOU.

____

SPECIAL NEEDS: ARE SPECIAL ROOMING ARRANGEMENTS ADVISABLE FOR YOU BECAUSE OF HEALTH PROBLEMS? IF SO, PLEASE EXPLAIN BELOW AND HAVE A PHYSICIAN'S STATEMENT MAILED BY JUNE 25 TO THE DIRECTOR OF HOUSING, WILLIAMS COLLEGE, 60 LATHAM ST., WILLIAMSTOWN, MA 01267.

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HALL PREFERENCE: AGAIN, PLEASE REMEMBER THAT YOU ARE LISTING A PREFERENCE. IT IS POSSIBLE THAT YOU WILL NOT RECEIVE YOUR FIRST CHOICE(S). PLEASE RANK YOUR PREFERENCES IN NUMERICAL ORDER WITH 1 BEING YOUR FIRST CHOICE AND 4 BEING YOUR FOURTH CHOICE. ENTER EACH NUMBER ONLY ONCE AND BE SURE TO RANK ALL FOUR CHOICES. FAILURE TO DO SO WILL CAUSE THE RANKING INFORMATION TO BE PROCESSED INCORRECTLY.

☐	WILLIAMS OR SAGE ALSO CALLED THE FRESHMAN QUAD	6 VERTICAL ENTRIES, SINGLE AND DOUBLE ROOMS, MAINLY IN SUITES, SOME ROOMS OFF A HALLWAY.
☐	MORGAN	4 VERTICAL ENTRIES, SINGLE, DOUBLE ROOMS, SOME IN SUITES AND SOME OFF A HALLWAY.
☐	LEHMAN	2 VERTICAL ENTRIES, SINGLE AND DOUBLE ROOMS, MAINLY IN SUITES.
☐	EAST OR FAYERWEATHER	3 HORIZONTAL ENTRIES, SINGLE AND DOUBLE ROOMS ALONG A HALLWAY

→

ROOMMATE MATCHING SURVEY: PLEASE USE THE BOXES TO THE LEFT OF ITEMS A – H TO RECORD YOUR ANSWERS. FOR QUESTIONS C-H CHOOSE THE ONE THAT IS CORRECT MOST OF THE TIME.

A. Would you prefer a single or a double? You must choose one of the choices listed below and place the appropriate response in box A.
   1. Single
   2. Double

B. Are you a smoker or non-smoker? If you smoke at all, you are a smoker and you are likely to be housed near other smokers. You must choose one of the choices listed below and place the appropriate response in box B.
   1. I am a smoker
   2. I am a non-smoker

C. How do you think you will feel towards visitors to your room? Please place the appropriate response in box C.
   1. enjoy frequent visitors
   2. like periodic visitors
   3. prefer not to have visitors

D. From the list below, please indicate in box D your least preferred activity.
   1. cultural (theater, symphony, etc.)
   2. video games
   3. concerts
   4. large parties

E. From the list below, please indicate in box E your least preferred musical taste.
   1. classical
   2. rock/pop
   3. heavy metal
   4. oldies
   5. rap

F. Place the number of your preferred study setting in box F.
   1. lots of noise / people
   2. some background noise / music
   3. silence

G. Place in box G the number which best describes the condition which you expect to keep your room.
   1. impeccably neat
   2. relatively organized
   3. somewhat cluttered
   4. hidden / buried floor
   5. disaster area

H. Place in box H the number which best describes your wake / sleep patterns.
   1. early riser / morning person
   2. early riser / daytime person
   3. early riser / evening person
   4. late riser / daytime person
   5. late riser / evening person
   6. late riser / night person

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